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Cutchis

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(54) **REMOTELY DIRECTED VEHICLE INSPECTION METHOD AND APPARATUS**

(75) Inventor: **Protagoras N. Cutchis**, Highland, MD (US)

(73) Assignee: **The Johns Hopkins University**, Baltimore, MD (US)

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(51) **Int. Cl.**
G08B 1/08 (2006.01)

(52) **U.S. Cl.** **340/539.22**; 340/521; 340/522; 340/540; 340/541; 348/143; 348/150; 348/158; 348/159; 600/127; 600/131; 600/160; 600/179; 600/508

(58) **Field of Classification Search** 340/539.22, 340/521, 522, 540, 541; 348/143, 150, 158, 348/159; 600/127, 131, 160, 179, 508
See application file for complete search history.

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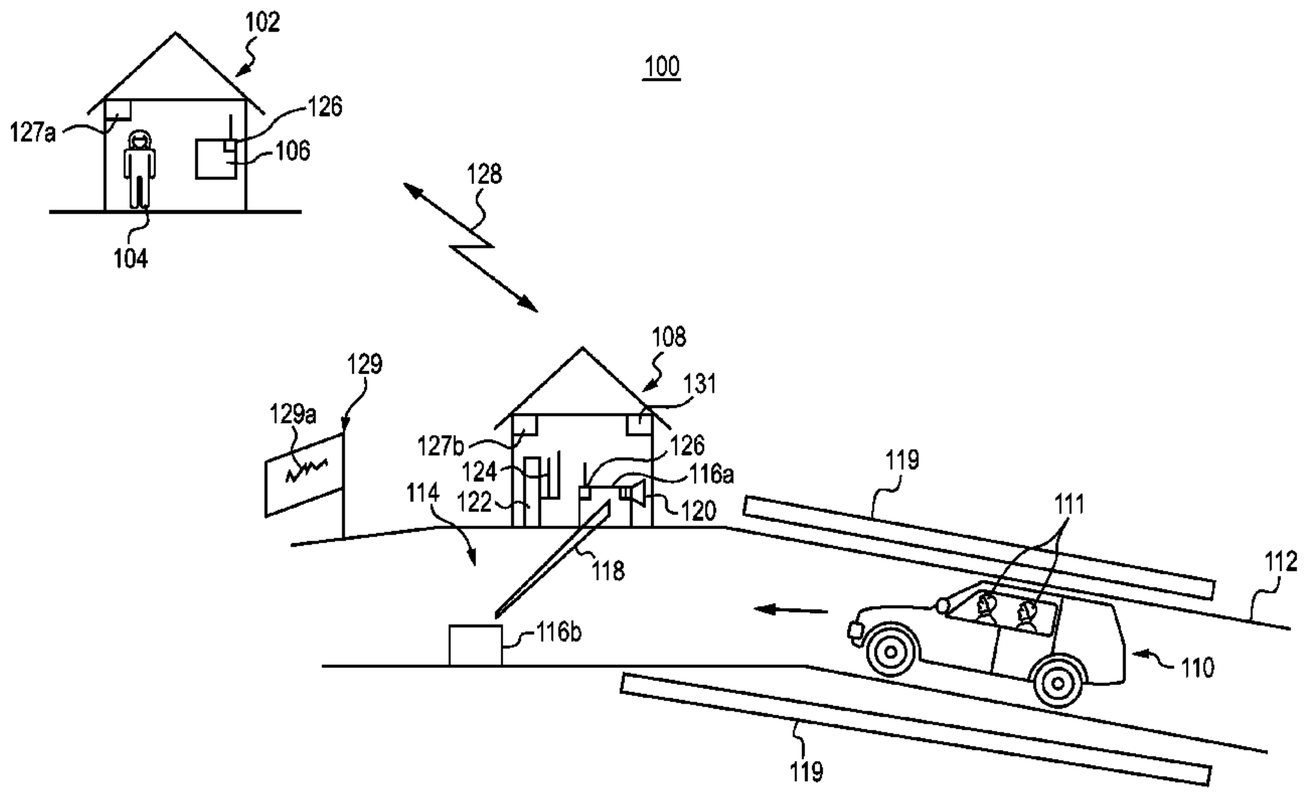
Primary Examiner — Tai T Nguyen
(74) *Attorney, Agent, or Firm* — Albert J. Fasulo, II

(57) **ABSTRACT**

A method of inspecting a vehicle, comprising providing at an inspection site a hand-held inspection wand that transceives audio-visual information with a command/remote site a safe distance from the inspection site and that is staffed by law enforcement personnel, stopping the vehicle at the remote site, instructing an occupant of the vehicle to exit the vehicle and grasp the wand, transmitting instructions from the command site to the occupant via the wand, that direct the occupant to capture video of the vehicle at the remote site using the wand, capturing video of the vehicle using the wand, transmitting the captured video from the wand to the command site, and displaying the transmitted captured video at the command site.

29 Claims, 9 Drawing Sheets



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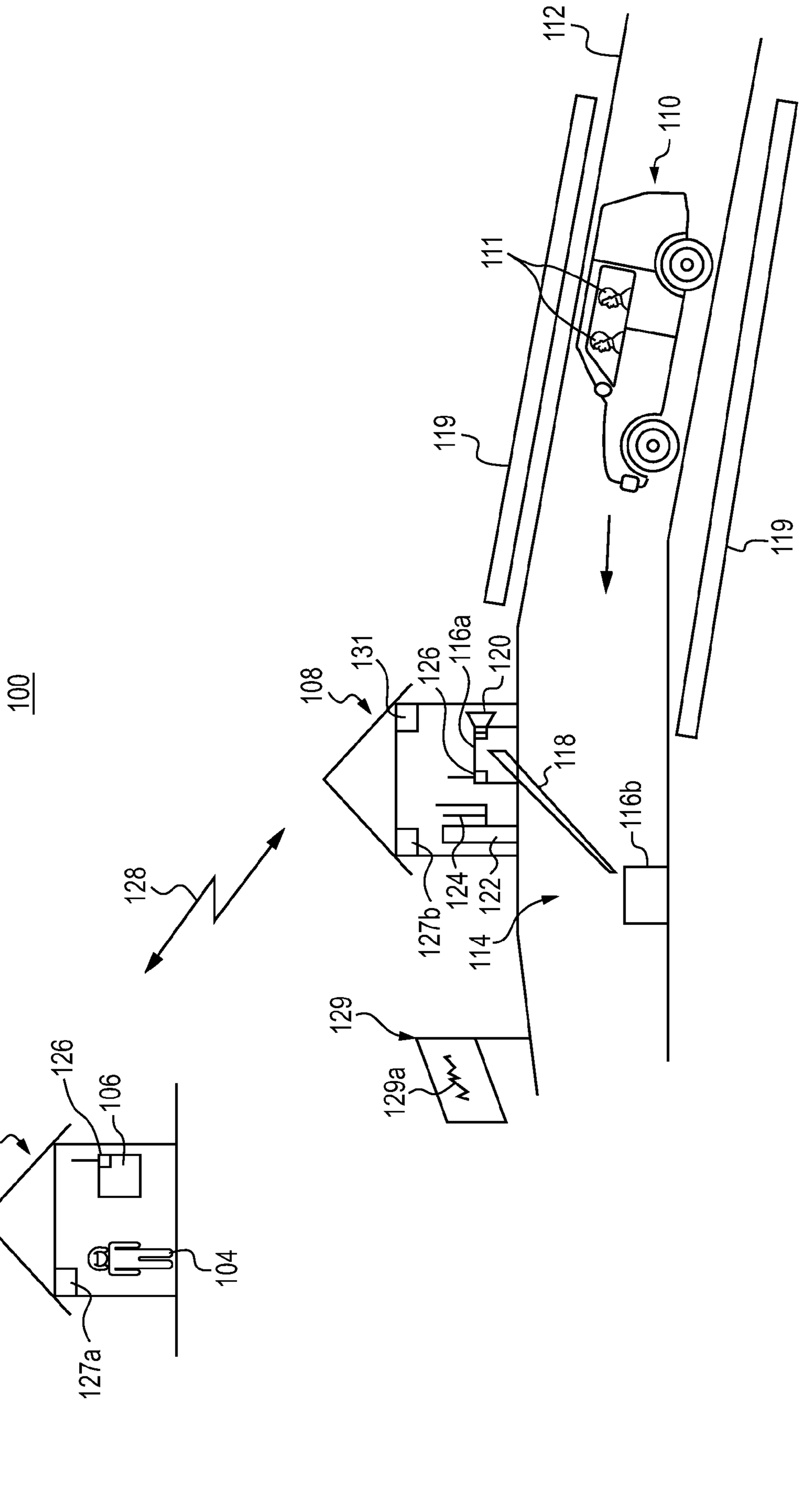
100
102
104
106
108
110
111
112
114
116a
116b
118
119
120
122
124
126
127a
127b
128
129
129a
131

FIG. 1

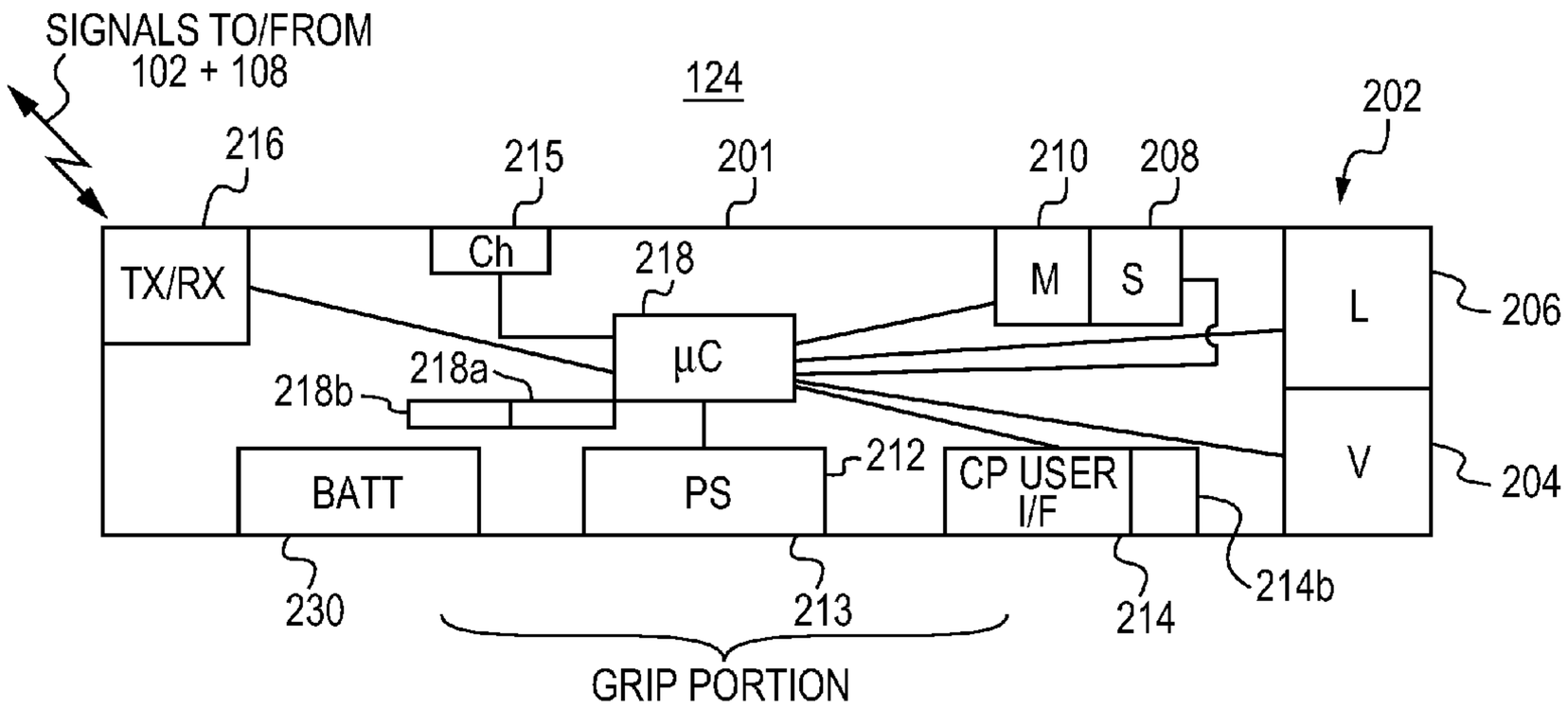
SIGNALS TO/FROM
102 + 108
124
202
216
215
201
210
208
TX/RX
Ch
218
M
S
L
206
µC
218a
218b
BATT
PS
212
CP USER
I/F
V
204
230
213
214
214b
GRIP PORTION

FIG. 2

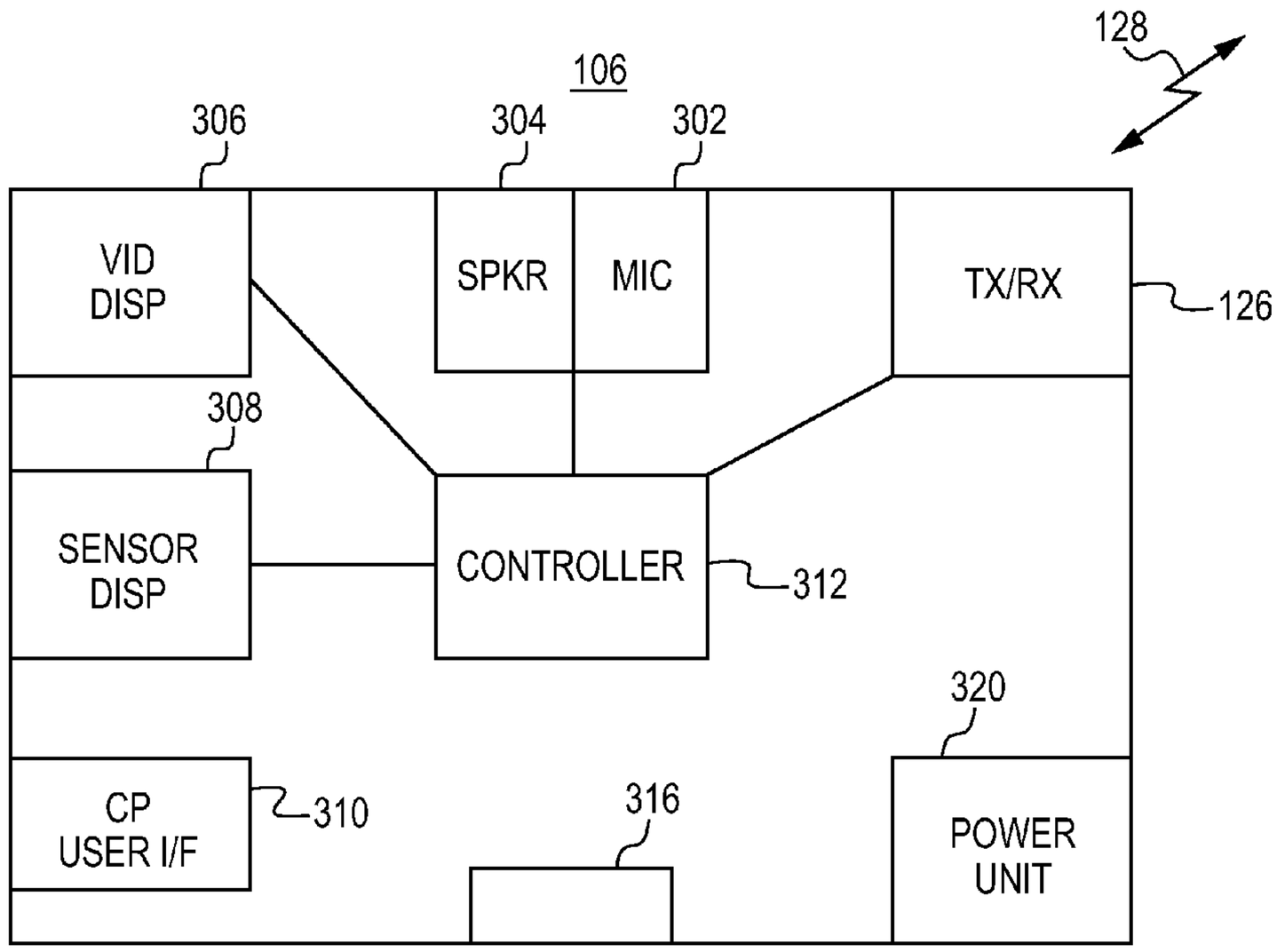
128
106
306
304
302
VID
DISP
SPKR
MIC
TX/RX
126
308
SENSOR
DISP
CONTROLLER
312
320
CP
USER I/F
310
316
POWER
UNIT

FIG. 3

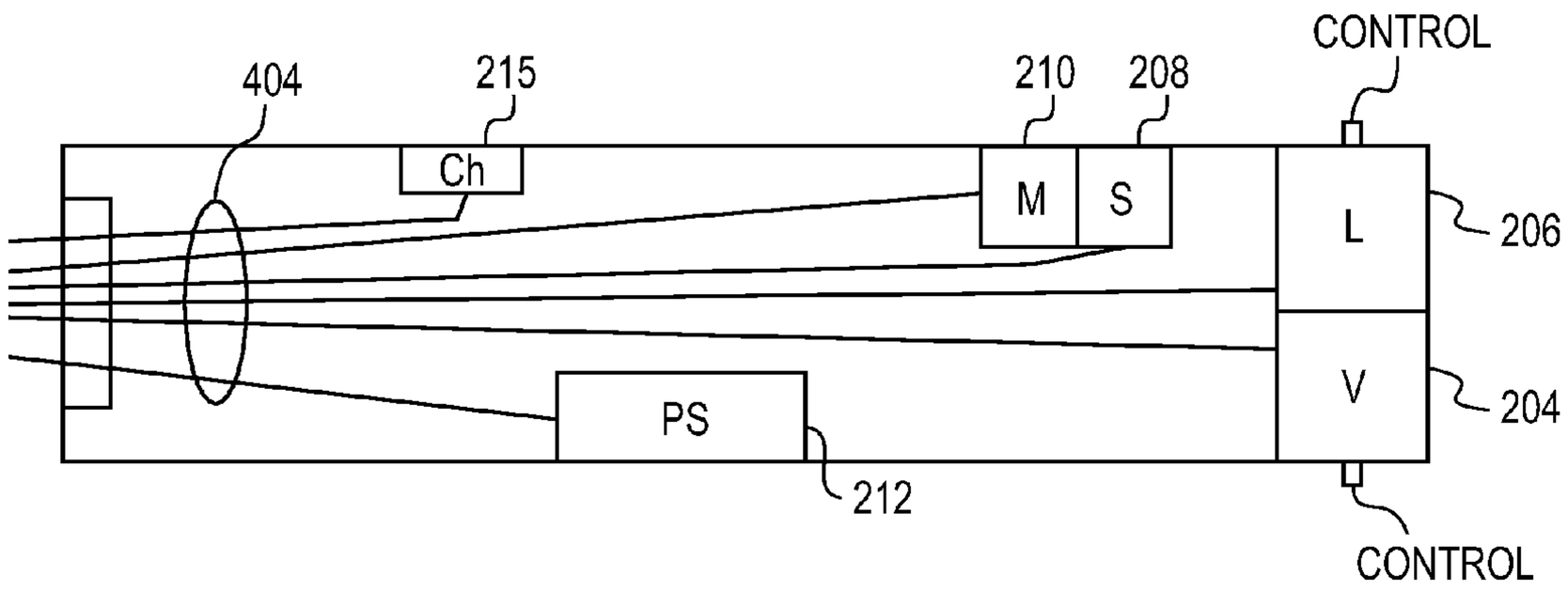

FIG. 4

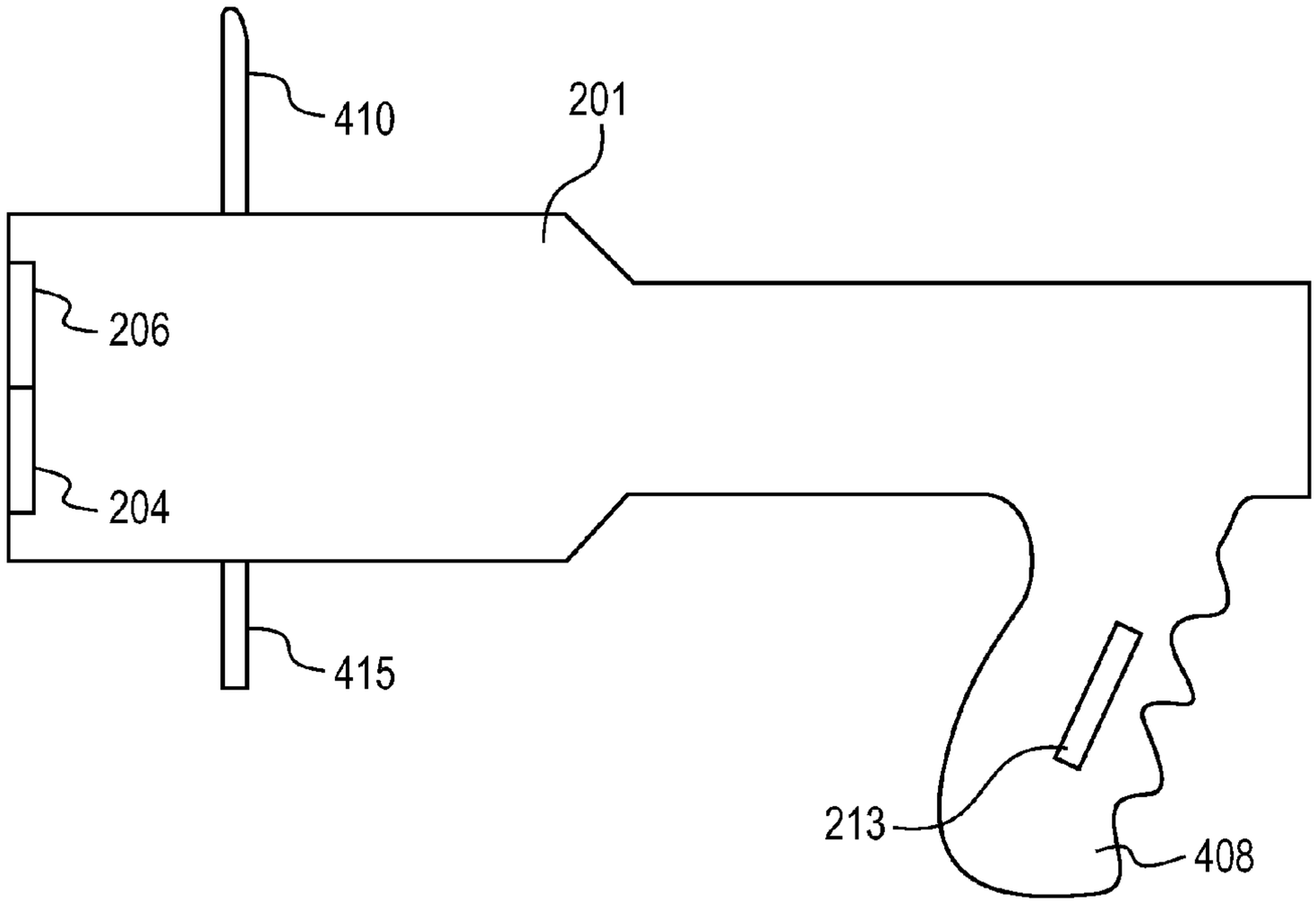

FIG. 4A

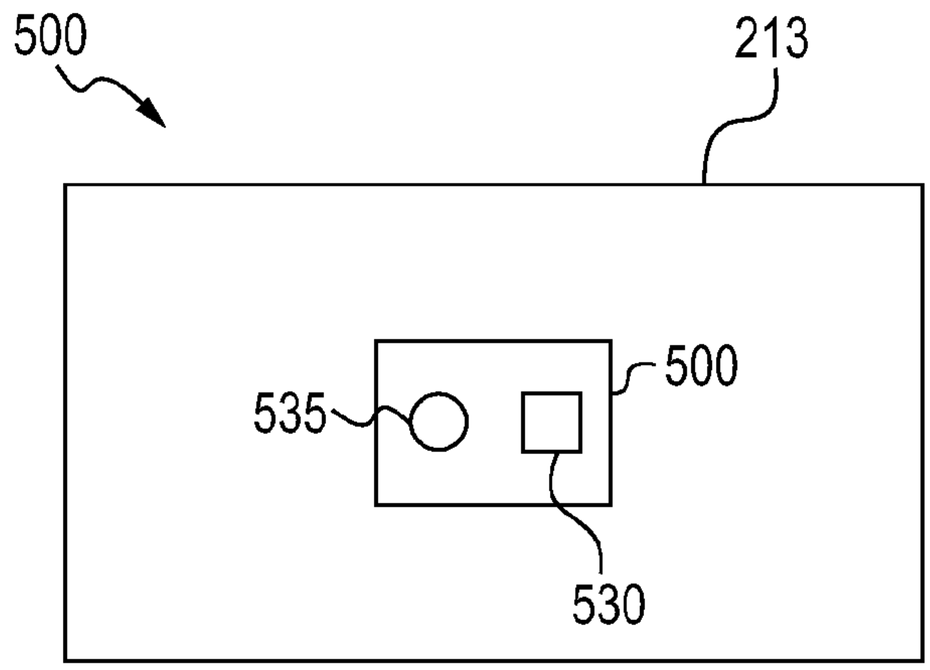
500
213
500
535
530

FIG. 5A

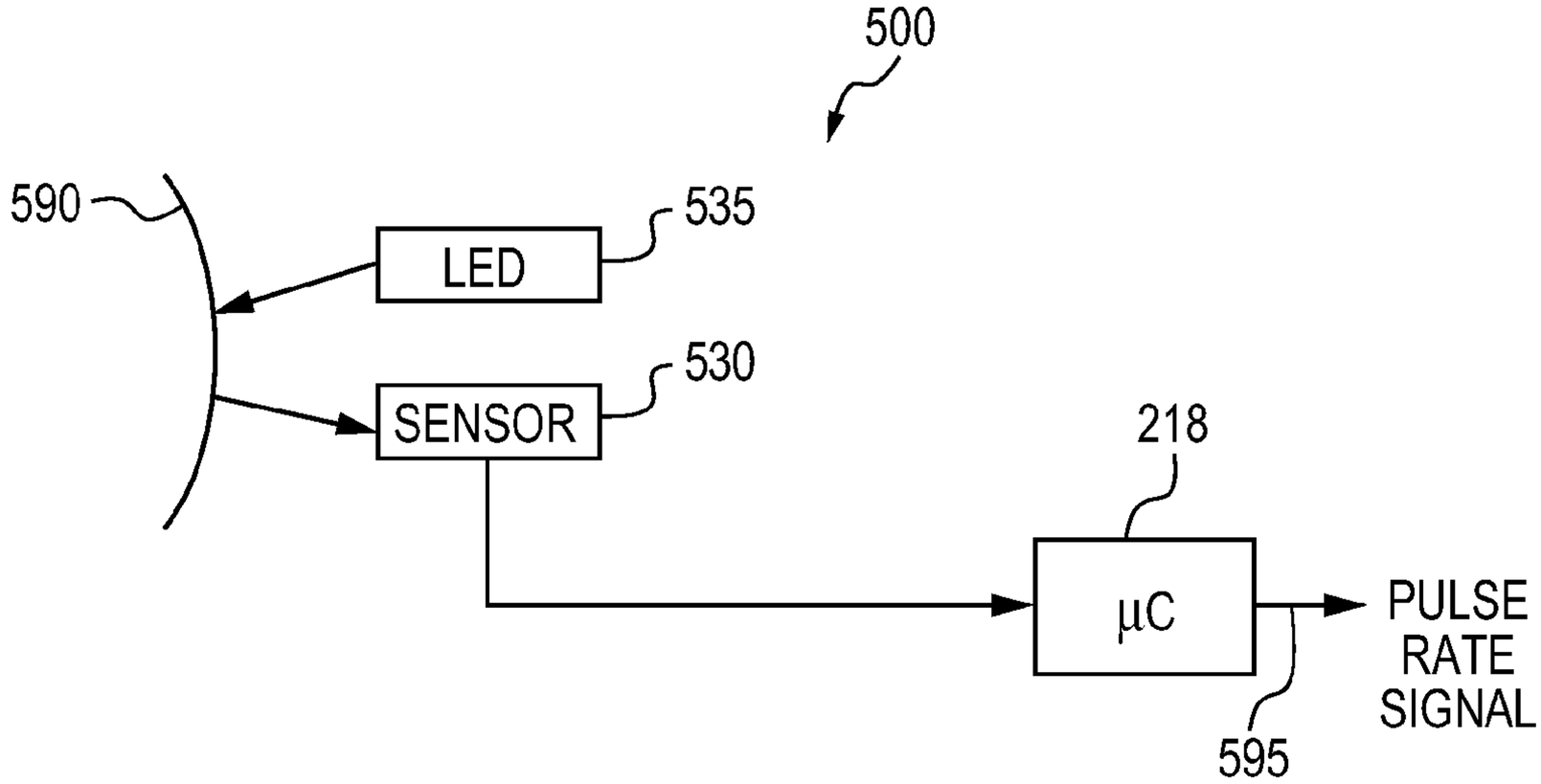
500
590
535
LED
530
SENSOR
218
μC
PULSE
RATE
SIGNAL
595

FIG. 5B

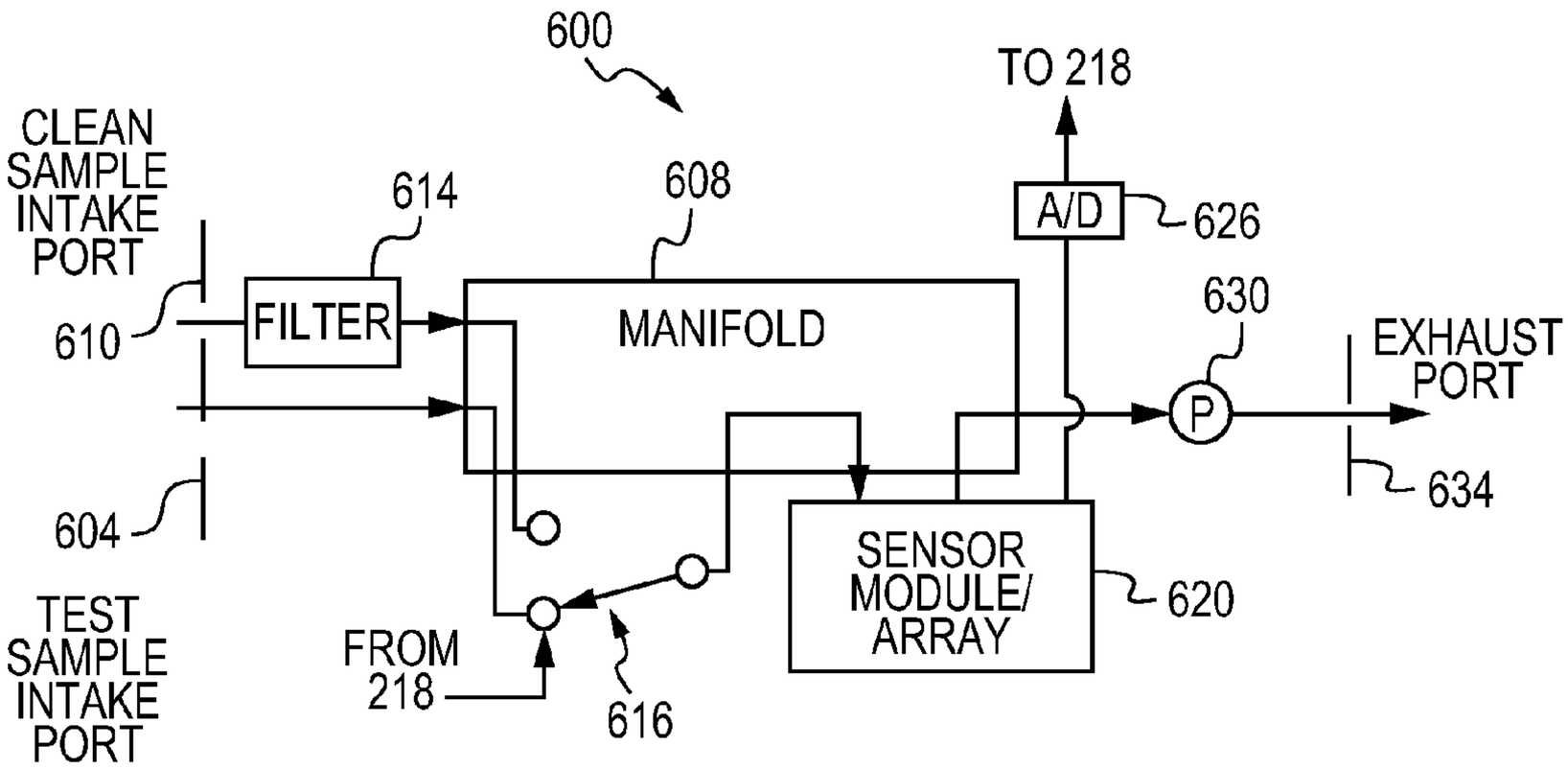
600
TO 218
CLEAN SAMPLE INTAKE PORT
614
608
A/D
626
610
FILTER
MANIFOLD
630
EXHAUST PORT
P
604
634
SENSOR MODULE/ ARRAY
620
TEST SAMPLE INTAKE PORT
FROM 218
616

FIG. 6A

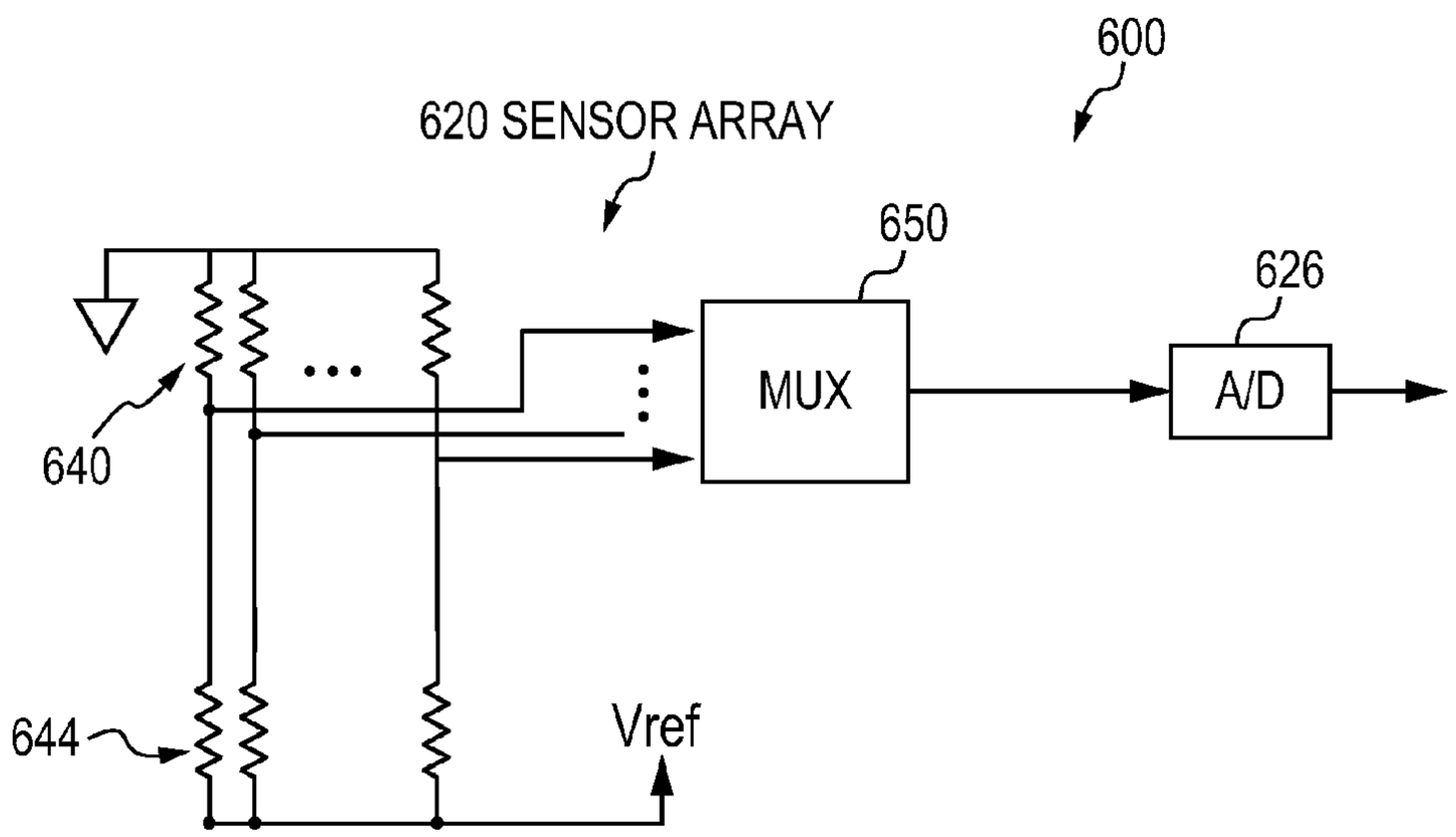
600
620 SENSOR ARRAY
650
626
MUX
A/D
640
644
Vref

FIG. 6B

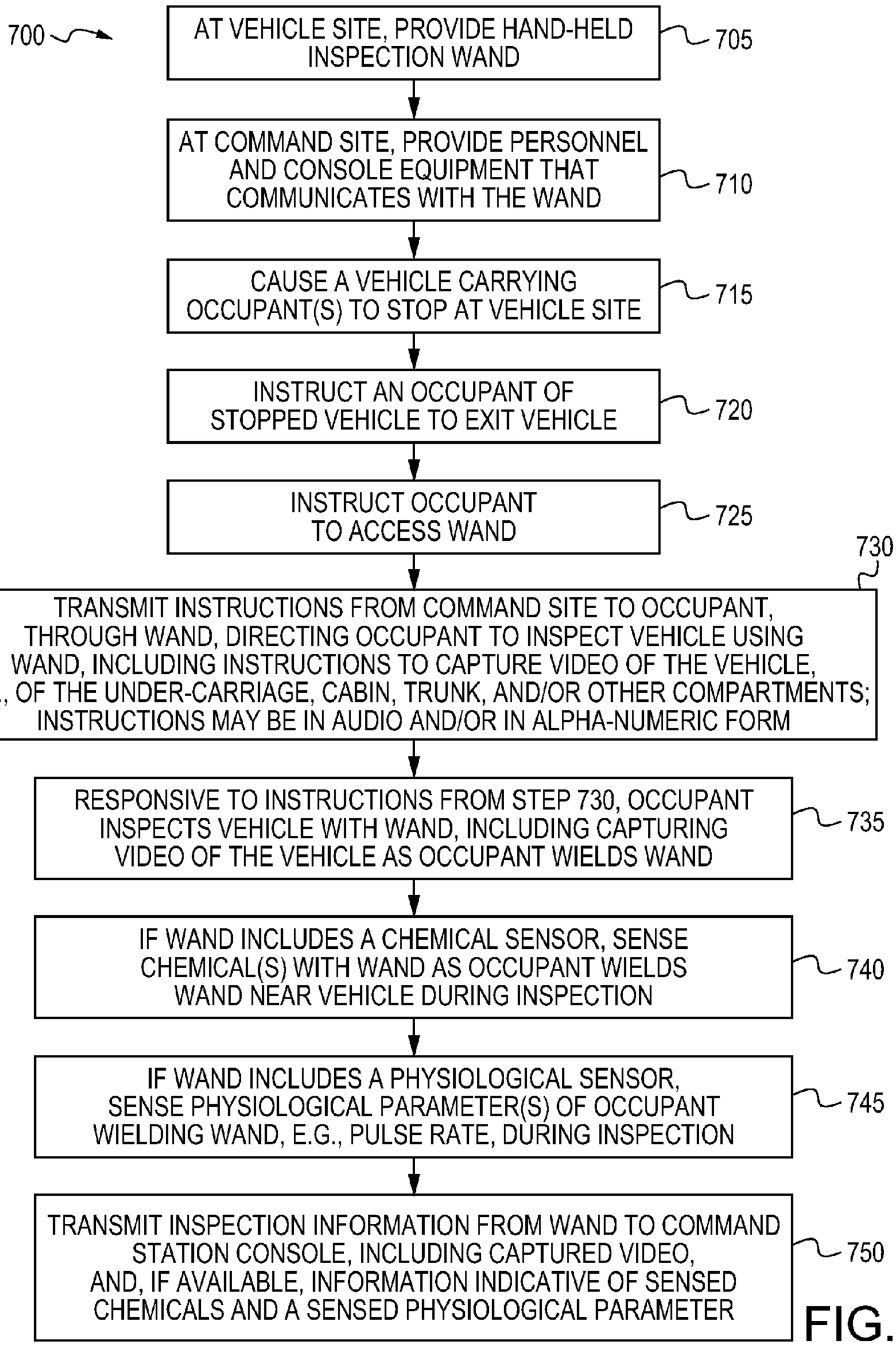
700
AT VEHICLE SITE, PROVIDE HAND-HELD INSPECTION WAND
705
AT COMMAND SITE, PROVIDE PERSONNEL AND CONSOLE EQUIPMENT THAT COMMUNICATES WITH THE WAND
710
CAUSE A VEHICLE CARRYING OCCUPANT(S) TO STOP AT VEHICLE SITE
715
INSTRUCT AN OCCUPANT OF STOPPED VEHICLE TO EXIT VEHICLE
720
INSTRUCT OCCUPANT TO ACCESS WAND
725
730
TRANSMIT INSTRUCTIONS FROM COMMAND SITE TO OCCUPANT, THROUGH WAND, DIRECTING OCCUPANT TO INSPECT VEHICLE USING WAND, INCLUDING INSTRUCTIONS TO CAPTURE VIDEO OF THE VEHICLE, E.G., OF THE UNDER-CARRIAGE, CABIN, TRUNK, AND/OR OTHER COMPARTMENTS; INSTRUCTIONS MAY BE IN AUDIO AND/OR IN ALPHA-NUMERIC FORM
RESPONSIVE TO INSTRUCTIONS FROM STEP 730, OCCUPANT INSPECTS VEHICLE WITH WAND, INCLUDING CAPTURING VIDEO OF THE VEHICLE AS OCCUPANT WIELDS WAND
735
IF WAND INCLUDES A CHEMICAL SENSOR, SENSE CHEMICAL(S) WITH WAND AS OCCUPANT WIELDS WAND NEAR VEHICLE DURING INSPECTION
740
IF WAND INCLUDES A PHYSIOLOGICAL SENSOR, SENSE PHYSIOLOGICAL PARAMETER(S) OF OCCUPANT WIELDING WAND, E.G., PULSE RATE, DURING INSPECTION
745
TRANSMIT INSPECTION INFORMATION FROM WAND TO COMMAND STATION CONSOLE, INCLUDING CAPTURED VIDEO, AND, IF AVAILABLE, INFORMATION INDICATIVE OF SENSED CHEMICALS AND A SENSED PHYSIOLOGICAL PARAMETER
750

FIG. 7

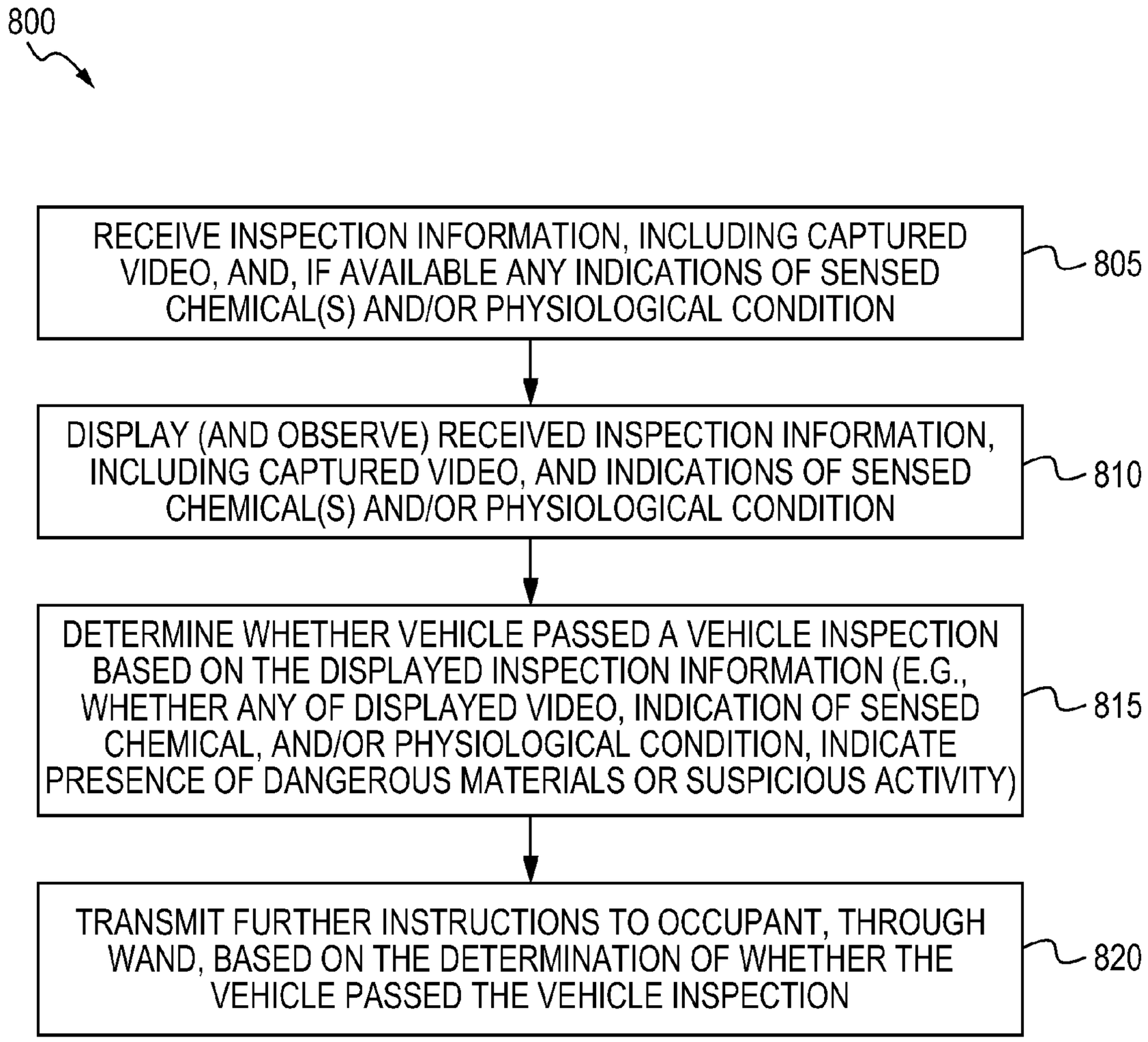
800
RECEIVE INSPECTION INFORMATION, INCLUDING CAPTURED VIDEO, AND, IF AVAILABLE ANY INDICATIONS OF SENSED CHEMICAL(S) AND/OR PHYSIOLOGICAL CONDITION
805
DISPLAY (AND OBSERVE) RECEIVED INSPECTION INFORMATION, INCLUDING CAPTURED VIDEO, AND INDICATIONS OF SENSED CHEMICAL(S) AND/OR PHYSIOLOGICAL CONDITION
810
DETERMINE WHETHER VEHICLE PASSED A VEHICLE INSPECTION BASED ON THE DISPLAYED INSPECTION INFORMATION (E.G., WHETHER ANY OF DISPLAYED VIDEO, INDICATION OF SENSED CHEMICAL, AND/OR PHYSIOLOGICAL CONDITION, INDICATE PRESENCE OF DANGEROUS MATERIALS OR SUSPICIOUS ACTIVITY)
815
TRANSMIT FURTHER INSTRUCTIONS TO OCCUPANT, THROUGH WAND, BASED ON THE DETERMINATION OF WHETHER THE VEHICLE PASSED THE VEHICLE INSPECTION
820

FIG. 8

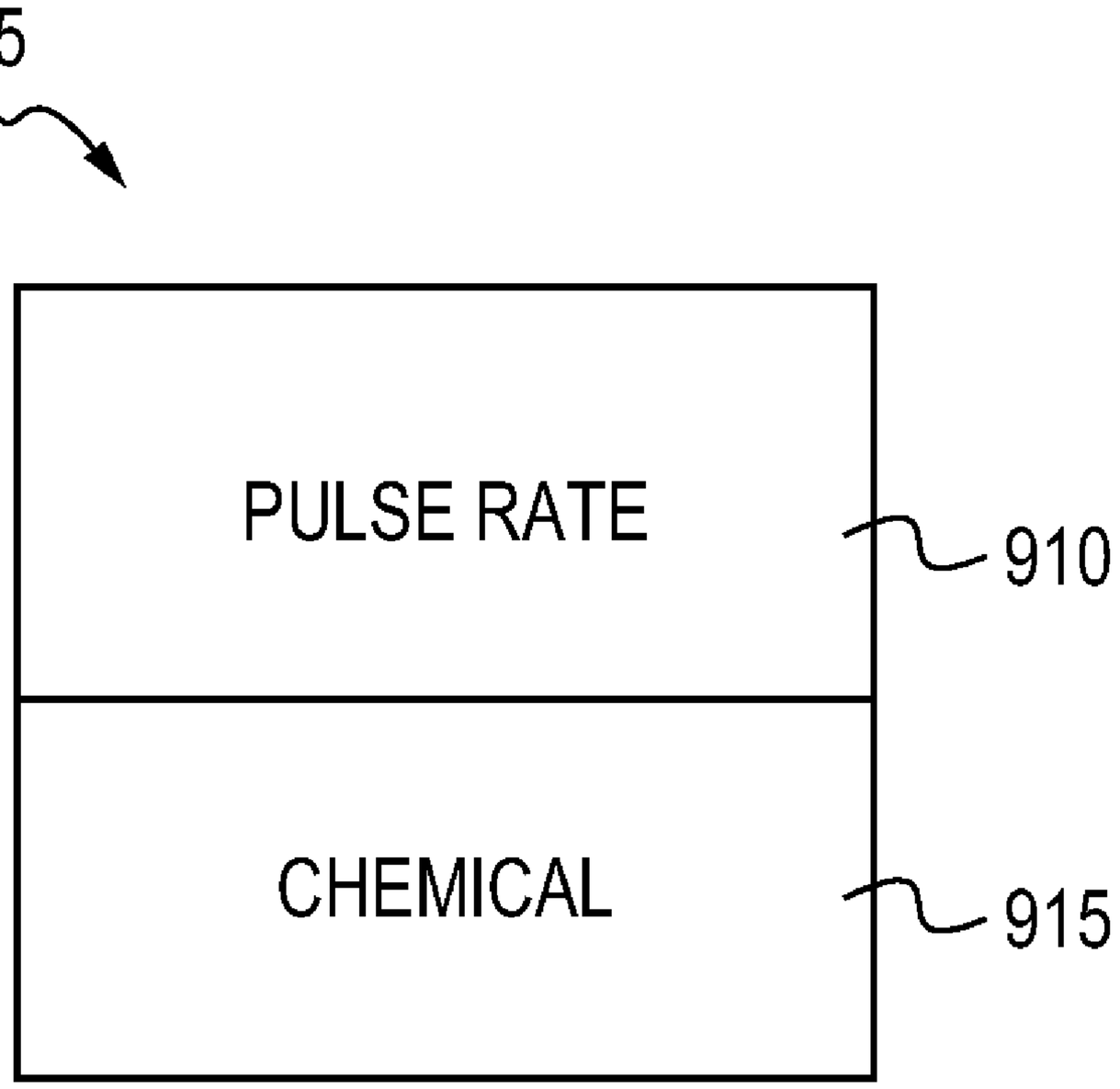

FIG. 9

REMOTELY DIRECTED VEHICLE INSPECTION METHOD AND APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application Ser. No. 61/045,430, filed Apr. 16, 2008, which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to remote inspections of vehicles, their occupants and contents.

2. Background

Terrorist attacks, including suicide bombings, directed against personnel and infrastructure are on the increase. Often, terrorists pack a vehicle, such as a car or truck, with explosives, and trigger the explosives as the vehicle is driven into a target. Targets include road side security check points staffed by security personnel who inspect vehicles and their occupants for suspicious activity and dangerous materials, such as explosives, or illicit drugs. Such security personnel, employing conventional inspection techniques, are in harms way because they are dangerously near the vehicle under inspection; likely, they will be killed when the vehicle is detonated. Accordingly, there is a need for security checkpoint systems and technique that enable security personnel to perform vehicle inspections at check points, while keeping the security personnel out of harms way.

SUMMARY OF THE INVENTION

Embodiments of the present invention satisfy the above need, while providing other advantages. Specifically, embodiments of the present invention enable security personnel staffing a command station or site (also referred to as the remote station or site) separated a safe distance from a vehicle inspection station or site to conduct an inspection of a vehicle that travels proximate the vehicle inspection site, such that if the vehicle were detonated during the inspection, the security personnel would remain uninjured.

An embodiment of the present invention includes a method of performing an inspection of a vehicle, comprising:

providing a vehicle inspection site proximate, e.g., in the path of, or along side, where the vehicle travels;

providing at the vehicle inspection site a hand-held portable inspection wand including a video camera that captures video in a field-of-view extending from an end of the wand, a speaker, a microphone, and transceiver components coupled with the video camera, speaker and microphone;

providing a command site separated a safe distance from the vehicle inspection site, the command site including equipment for displaying information and for transceiving information, including audio-visual information, with the wand;

staffing the command site with one or more personnel for commanding the inspection;

causing the vehicle to stop at the vehicle inspection site;

instructing an occupant of the vehicle to exit the stopped vehicle;

instructing the occupant to grasp the wand at the vehicle inspection site;

transmitting instructions from the command site to the occupant, over the safe distance and through the wand, that direct the occupant to capture video of the vehicle at the vehicle inspection site using the wand;

capturing video of the vehicle using the wand while the occupant uses the wand to inspect the vehicle responsive to the transmitted instructions;

transmitting the captured video from the wand to the command site; and

displaying the transmitted captured video at the command site.

Further method, system and apparatus embodiments are apparent from the description below.

BRIEF DESCRIPTION OF THE DRAWINGS

Various embodiments are described below with reference to the drawings.

FIG. **1** is an example vehicle check point system incorporating features of the present invention.

FIG. **2** is an example arrangement of a hand-held vehicle inspection unit or wand in accordance with the present invention.

FIG. **3** is an example arrangement of a console deployed in a remote or command station of the check point system.

FIG. **4** is a diagram of an alternative arrangement of the wand.

FIG. **4**A is a cross-sectional perspective view of another example wand including a pistol grip.

FIGS. **5**A and **5**B are diagrams of an example physiological sensor of the wand.

FIGS. **6**A and **6**B are diagrams of an example chemical sensor subsystem for monitoring/sensing one or more chemicals using the wand of the present invention.

FIGS. **7** and **8** are flowcharts of example methods performed in a vehicle checkpoint system, namely, of performing a remotely commanded/controlled stop and search of a vehicle approaching a station in the check point system of FIG. **1**.

FIG. **9** is an example message packet transmitted from the wand to the console of FIG. **1**.

DETAILED DESCRIPTION OF THE DRAWINGS

1. Checkpoint System

FIG. **1** is an example vehicle check point system **100** (also referred to as check point **100**) incorporating features of the present invention. Check point **100** includes a remote guard station or site **102** (also referred to herein as a command site) staffed by one or more guard personnel **104** who operate a console **106** constructed and operated in accordance with the present invention. Site **102** may include a protective edifice as depicted in FIG. **1**, but in an alternative arrangement, site **102** can include merely a laptop computer, operating as console **106**, and a guard interacting with the laptop. Check point **100** also includes a vehicle inspection station **108**, separated a safe distance from remote guard station **102**, for inspecting a vehicle **110**, carrying occupants **111**, that travels along a road **112** leading to the inspection station. A safe separation distance between stations **102** and **108** means a distance sufficiently large as to substantially reduce the impact of an exploding vehicle at or near station **108** on personnel **104** at station **102**. A safe separation distance is at least 1000 feet.

Vehicle inspection station **108** includes a barricade **114** remotely controlled from remote station **102**, and more specifically, via console **106** in station **102**, so as to selectively block or allow the passage of vehicle **110** through station **108**. Barricade **114** includes bollards **116***a*, **116***b* spaced apart across road **112**, and a movable arm or gate **118**, actuated at bollard **116***a*, extending between the bollards.

In an alternative arrangement, barricade **114** includes one or more sturdy (e.g., cement or steel, etc.), vertically displaceable, bollards embedded across road **112**. In this arrangement, the bollards are movable in a vertical direction, under remote control from station **102**, from (i) a stowed/retracted or hidden position, wherein the bollards are at or below a surface level of road **112** so as not to block the road, and (ii) a second deployed position wherein the bollards are extended (i.e., popped-up) above the road so as to block the road.

Side rails **119** may be disposed alongside road **112** as the road approaches barricade **114** so as to constrain the path of vehicle **110** to the road, i.e., to prevent the vehicle from easily bypassing inspection station **108**.

Inspection station **108** includes a loud speaker **120** for providing audio commands to one or more vehicle occupants **111** under control of console **106**, and a docking station **122** for retaining and battery charging a hand-held, portable vehicle inspection unit or wand **124** constructed and operated in accordance with the present invention. Both stations **102** and **108** include complementary wireless transceivers **126** for transceiving wireless signals **128** that carry information, including audio-visual information, and commands between the stations. In an arrangement, wireless signals **128** are communicated directly between a wireless transceiver in wand **124** and a wireless transceiver in console **106**, without any other intermediary transceivers.

A relatively large sign **129** deployed at station **108** displays indicia **129***a* thereon large enough to be viewed by occupants **111** as vehicle **110** approaches station **108**. In station **102**, console **106** includes transceiver **126**. In station **108**, bollard **116***a* can include transceiver **126**, which is coupled with speaker **120**, actuating logic for gate **118**, and docking station **122**. Through transceivers **126**, console **106** may transmit command signals to bollard **116***a* to open or close gate **118**, or may transmit audio to speaker **120**. In another arrangement, the above-described wireless link can be replaced by or augmented with a hard-wired link, e.g., electrical cables, for carrying the signals **128**, as well as electrical power between stations **102** and **108** for powering the various station subsystem described herein.

In lieu of, or in addition to, speaker **120**, stations **102** and **108** include a conventional two-way Public Announcement (PA) system **127**, for transmitting and receiving (i.e., transceiving) audio signals to and from one station to the next, including PA components/transceivers, speakers and microphones **127***a* (in station **102**) and **127***b* (in station **108**) linked to each other wirelessly or by wire. In this way, personnel **104** at station **102** can exchange audio commands with individuals at station **108** over PA system **127**, as would be appreciated by one of ordinary skill in the relevant arts.

Console **106** also includes electronics for remotely controlling, zooming, panning, or focusing, a wide FOV video camera **131** positioned at station **108**. The wide FOV of camera **131** is directed to view barricade **114**, road **112** leading to the barricade and surrounding areas. Video captured by camera **131** is relayed/fed to console **106** for display thereat, or at another separate video monitor, whereby personnel **104** can monitor a wide FOV encompassing vehicle **110** and its occupants **111** at or near station **108**.

2. Hand-Held Inspection Wand

FIG. **2** is an example arrangement of a hand-held vehicle inspection unit or wand **124**, constructed, sized and shaped to be easily grasped in a hand of a person/user and wielded by that user. In an arrangement, wand **124** includes a housing **201** generally cylindrical in shape and sized to be grasped by hand, like a standard flashlight. A first or probe end **202** includes a color video camera **204** having a field-of-view (FOV) directed away from end **202** and for viewing scenes in that FOV. End **202** also includes a visible light source, e.g., lamp and lens, **206** configured to direct light at, and thereby illuminate, the FOV. The FOV is arranged so that the user can simply point end **202** of wand **124** in the direction of, i.e., toward, a target scene and the camera will capture a video of that scene.

Wand **124** includes a speaker **208**, conformally embedded in housing **201**, for providing, i.e., announcing, audio to a user of wand **124**, and a microphone **210** for receiving audio from the user.

In an embodiment, wand **124** includes one or more physiological sensors **212**, conformally mounted in housing **210**, for covertly detecting/sensing one or more physiological parameters of the user, such as heart/pulse rate or moisture content from sweat, indicative of user stress. Sensor **212** includes a sensor pad **213** arranged at or near an outer surface of housing **201** so as to contact a portion of the user's hand, such as the user's palm or fingers when the user grasps wand **124**. Sensors(s) **212** can include a pulse oximeter sensor and/or a galvanic skin response sensor. Relevant portions of conventional sensors that can be used in the present invention are, e.g., disclosed in U.S. Pat. Nos. 7,431,696, 6,491,647, 6,558,320, 6,982,930, and 7,354,383, each of which is incorporated herein by reference in its entirety. Sensor **212** is described in further detail below in connection with FIGS. **5**A and **5**B.

Wand **124** can also include a chemical sensor **215** for detecting chemicals, e.g., in a vapor state, indicative of explosives or other dangerous chemicals, including contraband chemicals, such as illicit drugs. Sensor **215** is described in further detail below in connection with FIGS. **6**A and **6**B.

Wand **124** includes a user interface **214** through which the user may provide input to control features of the wand, such as a volume of speaker **208**, turn on and off light **206**, and so on. User interface **214** can be a single console, including a keypad, or can include multiple, physically separated interface control components, such as switches, each associated with a respective component, e.g., speaker **208** or light **206**, that it controls. In an alternative arrangement of wand **124**, and system **100**, wand **124** does not include control components in user interface **214**; instead, a similar remote user control interface resides in remote console **106**. In such an arrangement, personnel **104** control the functions of wand **124** remotely through this remote user control interface. In an arrangement of wand **124**, user interface **214** includes a small display **214***b*, e.g., a 2 inch by 2 inch liquid crystal display, for displaying alpha-numeric indicia, such as instructions and commands, to a user of wand **124**.

In another alternative arrangement, both wand **124** and console **106** can include control interfaces for both local or remote control of the functions of wand **124**.

In an arrangement, wand **124** includes a transceiver **216** that wirelessly transceives signals, carrying information and commands, with transceivers **126** in stations **102** and **108**. Any conventional wireless transceiving technology can be used to achieve this functionality. In an alternative arrangement, transceiver **216** may be hardwired to electronics at station **108**.

In an arrangement, wand **124** includes an embedded controller **218**, including associated memory **218***a* for storing instructions to be executed by the controller and information, and timer circuitry **218***b*, electrically coupled with the various wand components **204**, **206**, **208**, **210**, **212**, **214** and **215**, that controls overall operation of the components and exchanges control and information signals between them. Controller **218**, coupled with its associated memory, executes program

instructions that cause the controller to perform methods of the present invention. Controller **218** may include digital, analog, firmware, and/or a combination thereof. Each of the components **204**, **206**, **208**, **210**, **212**, and **215** can incorporate an analog-to-digital converter (ADC) and/or digital-to-analog converter (DAC), as appropriate, to support a digital architecture and digital processing in unit **124**, as would be appreciated by one of skill in the relevant arts.

In the arrangement depicted in FIG. **2**, a battery **230** provides power to all electrical components of wand **124**. Battery **230** includes connections enabling it to be electrically charged when seated in retainer **124** of station **108**.

An alternative simplified arrangement of unit **124** is depicted in FIG. **4**, wherein each of the components **204**, **206**, **208**, **210**, **212**, **214** and **215** transmits/receives its respective signal through a respective one of wires **404**, which terminate at either station **102** or **108**. In this arrangement of unit **124**, each of the components is controlled individually at the component itself, e.g., audio control, light on/off switch, etc. Wires **404** can carry electrical power to each of the components of unit **124** depicted in FIG. **4**. In addition, remote control of the components of unit **124** in FIG. **4** is provided through a remote control interface **316** of console **106** (see, e.g., console **106** in FIG. **3**).

FIG. **4**A is a cross-sectional perspective view of another example wand **407**. Wand **407** includes a pistol grip **408** that is grasped by a user. Wand **407** also includes an external antenna **410** coupled with wand transceiver **216**. Wand **407** also includes an optional external chemical sniffer probe **415** coupled with chemical sensor subsystem **600**.

FIGS. **5**A and **5**B are diagrams of an example physiological sensor **500**, corresponding to physiological sensor **212**, for monitoring/sensing a pulse rate and a blood oxygenation level of a user grasping wand **124**. With reference to FIG. **2** and both of FIGS. **5**A and **5**B, a user grasps wand **124** in such a way as to put a portion **590** of the user's hand in contact with a surface of pad **213** embedded in housing **201**. A light source **535**, e.g., a light emitting diode (LED), transmits light through at least one artery in the user's hand. A photodetector **530** detects the transmitted light and provides a detected signal indicative thereof to microcontroller **218** of wand **124**. Microcontroller **218** determines a pulse rate based on the detected signal, and generates a pulse rate signal or message **595** indicative of the pulse rate and blood oxygenation level, and suitable for transmission from wand **124**, via transceiver **216**, to console **106** for display at the console. Except for any differences described above, physiological sensor **500** may be constructed and operated substantially in accordance with sensor **30**, and its associated processing, described in detail in U.S. Pat. No. 7,431,696 to Brady et al., which is incorporated herein by reference in its entirety.

FIGS. **6**A and **6**B are diagrams of an example chemical sensor subsystem **600**, corresponding to chemical sensor **215**, for monitoring/sensing one or more chemicals using wand **124**. With reference to FIG. **6**A, housing **201** of wand **124** includes a test sample intake port **604** embedded therein through which a test sample is drawn and provided to a manifold **608**. Similarly, housing **201** includes a reference or background intake port **610** therein through which a reference sample is drawn and provided through a filter **614** to manifold **608**. Manifold **608** directs the test and reference samples to a solenoid **616** that selects one of the samples as the solenoid output under switching control of controller **218**. Manifold **608** directs the selected sample to a sensor module **620** that detects analytes in the selected sample. Sensor module **620** includes multiple sensors that detect multiple analytes in the selected sample. Sensor module **620** generates a signal or signature indicative of the detected analytes, which is digitized by analog-to-digital (A/D) circuit **626**. A/D **626** provides the digitized detected analyte signal to controller **218** for processing thereby, that is, controller **218** determines the presence of chemical(s) based on the digitized signal from A/D **626**, and generates a message indicative of this determination for transmission, via transceiver **216**, station **102** for display thereat. The selected sample is then provided from sensor module **620**, through manifold **608**, further through a miniature pump **630**, and to/out an exhaust port **634** formed in housing **201**.

FIG. **6**B is an illustration of an exemplary arrangement of sensor module **620**. Sensor module **620** includes multiple chemically sensitive resistors **640**, each providing a particular characteristic response or signature when exposed to a test sample carrying analytes to be sensed. The circuitry depicted in FIG. **6**B, in combination with controller **218**, measures the resistances of the resistors **640** and processes the measurements to identify the test sample. Reference resistors **644**, one per sense resistor **630**, improve the performance of the sense resistors. A multiplexer **650** selects, in sequence, the chemically sensitive resistors **640**. Except for the differences described above, chemical sensor subsystem **600**, operating in conjunction with processor **218**, may be constructed and operated substantially in accordance with chemical sensor **412**, and controller **410**, described in detail in U.S. Pat. No. 6,234,006 to Sunshine et al., which is incorporated herein by reference in its entirety. Chemically sensitive resistors, and systems and methods of using same for sensing chemicals, usable in the present invention, are disclosed in U.S. Pat. No. 5,571,401, and in PCT Patent Application Ser. No. WO99/08105, entitled "Techniques and Systems for Analyte Detection," published Feb. 19, 1999, each of which is incorporated herein by reference in its entirety. Example arrangements of sensor **600** detect chemicals indicative of dangerous substances, such as explosives, and illicit drugs.

3. Remote Station Console

FIG. **3** is an example arrangement of console **106** in remote station **102**. Console **106** includes various console components, including transceiver **126** that communicates with its counterpart **216** in wand **124**, a microphone **302** for transducing audio from personnel **104** that is destined for vehicle occupants **111** at station **108** (e.g., through PA system **127** or, alternatively, through wand **124**), a speaker **304** for announcing audio received from occupants **111** at station **108**, a video display **306** for displaying video captured/recorded by wand camera **204** and camera **131**, a sensor display **308** for displaying one or more sensed physiological parameters and sensed chemical indicators measured by wand sensors **212**, **215** a console user interface **310** through which personnel **104** can provide control inputs to the console components, and a controller **312** coupled with each of the aforementioned console components for controlling overall operation of the console and routing signals between the console components. Sensor indications may be displayed on video display **306** instead of separate display **308**. Console **106** may include a conventional general purpose computer and display to provide many of the functions listed above. For example, console **106** may be a portable or laptop computer having a conventional wireless interface for communicating with wand **124**. Controller **312**, coupled with its associated memory, executes program instructions that cause the controller **312** to perform methods of the present invention, including transferring messages between the console transceiver **126** and the various other console components as necessary to effect these methods. Console **106** also includes a power unit **320** to power electrical subsystems of the console. Console **106** may be packaged

in any convenient manner, including, for example, in a portable suitcase form factor, so that the console can be easily and quickly carried and deployed in remote territories.

Console **106** also includes a wand control user interface **316** for remote control of the functions of wand **124** by personnel **104**. User interface **316** includes control interfaces similar to those of interface **214** described above in connection with FIG. **2**.

Electrical communication between electrical components of station **102**, e.g., console **106** and PA **127***a*, and electrical components at station **108**, e.g., wand **124**, bollard **116***a*, camera **131**, and PA **127***b*, can be wireless, wired, or a combination of both, and is supported by the necessary wireless and/or wired transceivers, as would be appreciated by those having skills in the relevant arts.

As can be appreciated from the foregoing description, signals **128** represent a communication link between console **106** in station **102** and station **108**, namely, wand transceiver **216** and/or transceiver **126** in station **108**. Communication link **128** carries information, including audio-visual information, between wand **124** and console **106**. In addition to audio-visual information, the information transmitted in the direction of wand **124** to console **106** includes messages indicating sensed physiological conditions, e.g., pulse rate, and sensed chemical(s), which are interpreted and displayed at console **106**. In an arrangement of wand **124** including an alpha-numeric display, communication link **128** also carries alpha-numeric instructions transmitted from console **106** to wand **124**.

4. Method Flowcharts

FIGS. **7** and **8** are flowcharts of example methods **700** and **800**, respectively, performed in vehicle checkpoint system **100**, namely, of performing a remotely commanded/controlled stop and search of vehicle **110** approaching station **108** from along road **112**.

With reference to FIG. **7**, in an initial step **705**, system **100** is initially configured so that barricade **118** is positioned so as to block traffic traveling along road **110**, e.g., gate **118** is in its lowered or closed position. In addition, hand-held unit/wand **124** is provided at station **108** in a stowed position in retainer **122**.

In another initial step **710**, one or more of the law enforcement or guard personnel **104** charged with performing inspections of vehicles at station **102**, remotely, i.e., from the safety of remote station **108**, are provided at remote station **102**. For safety, no guard personnel are provided at station **102**. Also, console **106** is provided at station **102** for interaction with personnel **104**. Throughout the ensuing steps, personnel **104** can view activity at station **108** through video captured by camera **131** and transmitted to console **106** for display thereat. In addition, personnel **104** can transmit verbal/audio directions to station **108** through PA system **127**, can transmit audio instructions to wand **124**, and, in an arrangement of the wand including an alpha-numeric display, can transmit alpha-numeric instructions to the wand. Wand **124** can transmit audio and captured video to console **106**.

In a step **715**, vehicle **110** carrying one or more of the occupants **111** comes into the FOV of camera **131** as it approaches closed gate **118**, and then comes to a stop at the gate, i.e., gate **118**, and/or bollards are disposed as to cause vehicle **110** to stop at the gate. Also, indicia **129***a* on sign **129** can instruct occupants **111** to stop their vehicle.

In next steps **720** and **725**, at least one of vehicle occupants **111** is instructed to exit stopped vehicle **110**, walk to retainer **122**, grasp hand-held unit **124**, and remove the unit from the retainer. In these steps, instructions can be provided to occupants **111** to perform these tasks via (i) indicia **129***a* displayed on sign **129** and viewed by occupants **111** in stopped car **110**, and/or (ii) audio instructions originated by personnel **104** and transmitted to station **108** over PA system **127**. Occupants **111** can converse with personnel **104** over PA system **127**.

In a next step **730**, from the relative safety of station **102**, personnel **104** command the occupant **111**, in possession of wand **124** after step **725** (also referred to as the "user"), to inspect vehicle **110** to a desired level using wand **124**. In support of this, personnel **104** transmit detailed audio instructions from station **102** to the user via, e.g., wireless signals **128** and through wand **124**; audio signals from station **102** that are received at wand transceiver **216** are provided to wand speaker **208** and announced to user **111**. In a reverse direction, the user **111** can provide audio feedback to personnel **104** by speaking into wand microphone **210**, which transduces audio and provides same to wand transceiver **216**, which transmits the audio signal to console transceiver **126**, which provides the audio to speaker **304** of console **106**. In this way, personnel **104** and user **111** can engage in a two-conversation, should the user need feedback and redirection from personnel **104** (e.g., personnel **104** can respond to audio inquiries—or even gestures viewed through camera **131**—from the user, and give any number or level of detailed audio instructions to cause the user **111** to point wand **124** in a desired, open and close vehicle compartments, etc). In an arrangement of wand **124** including an alpha-numeric display, personnel **104** can also transmit alpha-numeric instructions to user **111** via wireless signals **128** and the wand. Also, at any step, personnel **104** can turn-on lamp **206** to illuminate a video FOV. At, or prior to, this step **730**, personnel **104** ensure that the electrical components of wand **124**, e.g., **204**, **206**, **208**, **210**, **212**, **214**, **215** and **218**, are powered on.

In step **730**, personnel **104** transmit instructions that command user **111** to perform a partial/quick or, alternatively, a complete video inspection of vehicle **110**. For example, the instructions can direct user **111** to capture video of one or more of the entire vehicle cabin interior (including glove compartment and under seats), trunk, engine compartment, undercarriage, etc.

In a next step **735**, responsive to the instructions of step **730**, user **111** uses wand **124** to inspect vehicle **111**, by pointing end **202** of the wand toward a target to be illuminated by light **206** and captured in the FOV of camera **206**; in this way, wand **124** captures video of vehicle **111**. The wand should be held within about less than 10 feet from the vehicle in order to capture clear video.

In a step **740** performed in connection with an arrangement of wand **124** including chemical sensor **215**, wand **124** senses for the presence of chemical(s) (e.g., indicative of explosives and/or contraband, such as drugs) as user **111** wields the wand near vehicle **110** during step **735**.

In a step **745** performed in connection with an arrangement of wand **124** including physiological sensor **212**, the wand senses physiological parameter(s) of user **111** as the user wields the wand. For example, sensor **212** senses a pulse rate of user **111** from a palm of the user while the user grasps wand **124**.

In a step **750**, wand **124** transmits inspection information, including the video of vehicle **111** captured in step **735**, to station **102**, e.g., console **106**, via communication link **128**. Inspection information also includes indications of sensed chemical(s) and indications of sensed physiological parameters (e.g., pulse rate) as available from steps **740** and **745**.

Throughout each of the steps **715**-**750** in method **700**, personnel **104** charged with controlling/commanding the search are present only at the command site **102**, not at site **102**.

Method **800** is performed at station **102** and operates in conjunction with method **700**. In a step **805**, station **102**, through console **106**, receives the inspection information, e.g., captured videos, and indications of sensed chemical(s) and physiological parameters, if available.

In a step **810**, console **106** displays the received inspection information, including the captured video and indications as available.

In a step **815**, personnel **104** view the displayed inspection information and, based on these observations, as well as the audio from user **111**, if any, determine whether the vehicle passed a vehicle inspection and whether to then allow vehicle **110** and its occupants to pass through station **108**, i.e., to proceed along road **112**. If the displayed inspection information indicates the presence of dangerous or contraband materials, such as explosives, drugs, etc., or suspicious behavior from occupants **111**, then vehicle **110**/occupants **111** will be deemed to have failed the inspection.

In an embodiment where user pulse rate is detected by wand **124**, transmitted to station **102** and displayed thereat, personnel **104** monitor the displayed pulse rate against a pass/fail criteria in order to determine whether the inspection is passed in step **815**. An example fail criterion is if the user's pulse rate increases more than 30% during the course of the inspection, e.g., from 90 beats/minute to approximately 120 beats/minute, indicating an unusually heightened level of anxiety in the user. Another example fail criterion is if the user's pulse rate exceeds 130 beats/minute.

In an embodiment where chemical(s) are sensed, an example fail criterion is if a displayed sensed chemical matches a chemical listed on a manifest of dangerous chemicals available to personnel **104**. An example manifest would list chemicals indicative of dangerous or illegal substances, such as explosives and/or illegal drugs.

In a next step **820**, if personnel **104** determine that vehicle **110** can pass, then personnel **104** transmit instructions to user **111** directing the user to return unit **124** to retainer **122**, return to vehicle **110**, and then proceed in vehicle **110**. Personnel **104** enter a command at console **106** to remove the barricade, i.e., raise gate **118**, so as to allow vehicle **110** to pass barricade **114**. After vehicle **110** passes, then personnel **104** enter a command at console **106** to lower gate **118**.

Conversely, if personnel **104** determine that vehicle **110** has failed inspection and, essentially, can not pass barricade **114**, then personnel **104** transmit instructions to occupants **111** directing them to either remain in the vehicle or, alternatively, leave the vehicle, pending further action and instructions from personnel **104**. Alternatively, vehicle **110** can be commanded to proceed through the barricade as if the inspection had passed, only to be subverted to another inspection station.

Throughout each of the steps in method **800**, personnel **104** charged with controlling/commanding the search are present only at the command site **102**, not at site **102**.

FIG. **9** is an illustration of an example message packet **905** transmitted from wand **124** to console **106**, over communication link **128**. Message packet **905** includes a first field **910** including a value representative of a pulse rate and, in an arrangement of wand **124** that also includes chemical sensor, a second field **915** including an indicator of a type of chemical sensed by the chemical sensor, if any.

While the above description contains many specifics, these specifics should not be construed as limitations of the invention, but merely as exemplifications of preferred embodiments thereof. Those skilled in the art will envision many other embodiments within the scope and spirit of the invention as defined by the claims appended hereto.

What is claimed is:

1. A method of performing an inspection of a vehicle, comprising:

providing a vehicle inspection site proximate where the vehicle travels;

providing at the vehicle inspection site a hand-held portable inspection wand including a video camera that captures video in a field-of-view extending from an end of the wand, a speaker, a microphone, and transceiver components coupled with the video camera, speaker and microphone;

providing a command site separated a safe distance from the vehicle inspection site, the command site including equipment for displaying information and for transceiving information, including audio-visual information, with the wand;

staffing the command site with one or more personnel for commanding the inspection;

causing the vehicle to stop at the vehicle inspection site;

instructing an occupant of the vehicle to exit the stopped vehicle;

instructing the occupant to grasp the wand at the vehicle inspection site;

transmitting instructions from the command site to the occupant, over the safe distance and through the wand, that direct the occupant to capture video of the vehicle at the vehicle inspection site using the wand;

capturing video of the vehicle using the wand while the occupant uses the wand to inspect the vehicle responsive to the transmitted instructions;

transmitting the captured video from the wand to the command site; and

displaying the transmitted captured video at the command site.

2. The method of claim **1**, further comprising:

at the command site, observing the displayed captured video; and

at the command site, determining whether the vehicle has passed the vehicle inspection based on the observed video.

3. The method of claim **2**, wherein all of said steps of staffing, causing, instructing an occupant, instructing the occupant, transmitting instructions, capturing video, transmitting the captured video, displaying, observing and determining are performed while personnel for commanding the inspection are present only at the command site, not the inspection site.

4. The method of claim **2**, further comprising:

if it is determined that the vehicle passed the vehicle inspection, then transmitting instructions from the command site to the occupant, over the safe distance and through the wand, that direct the occupant to return to the vehicle and continue past the inspection site.

5. The method of claim **1**, wherein said step of transmitting instructions includes wirelessly transmitting the instructions from the command site to the wand.

6. The method of claim **5**, further comprising:

prior to said step of wirelessly transmitting instructions, originating audio instructions at the command site,

wherein said step of wirelessly transmitting instructions includes

wirelessly transmitting the audio instructions originated at the command site to the wand, and

announcing the audio instructions through the speaker of the wand.

7. The method of claim 5, wherein step of wirelessly transmitting instructions further comprises wirelessly transmitting from the command site to the occupant, through the wand:

an instruction that directs the occupant to capture video of the undercarriage of the vehicle; and

an instruction that directs the occupant to capture video of a cabin interior of the vehicle.

8. The method of claim 5, wherein said step of wirelessly transmitting instructions further comprises wirelessly transmitting from the command site to the occupant, through the wand:

an instruction to open a closed compartment of the vehicle and capture video of an interior of that compartment once opened.

9. The method of claim 5, wherein the wand further comprises a display, the method further comprising:

prior to said step of wirelessly transmitting instructions, originating alpha-numeric instructions at the command site,

wherein step wirelessly transmitting instructions comprises

wirelessly transmitting the alpha-numeric instructions originated at the command site to the wand, and

displaying the audio instructions on the wand display.

10. The method of claim 5, wherein the wand further comprises a physiological sensor for sensing a physiological condition while the wand is being grasped, the method further comprising:

sensing via the wand a physiological condition of the occupant while the occupant grasps the wand; and

wirelessly transmitting from the wand to the command site information indicative of the sensed physiological condition; and

at the command site, displaying a representation of the sensed physiological condition as indicated in the transmitted information.

11. The method of claim 10, wherein:

said sensing includes sensing a heart rate of the occupant; and

said displaying includes displaying a representation of the sensed heart rate.

12. The method of claim 10, further comprising:

at the command site, determining whether the vehicle has passed a vehicle inspection based on the displayed captured video and the displayed representation of the physiological condition.

13. The method of claim 10, wherein the wand further comprises a chemical sensor, the method further comprising:

sensing via the wand a presence of a chemical indicative of explosives;

transmitting information indicative of whether the chemical is sensed; and

at the command site, displaying a representation of whether the chemical is sensed as indicated in the information.

14. The method of claim 13, further comprising:

at the command site, determining whether the vehicle has passed a vehicle inspection based on

the displayed captured video,

the displayed representation of whether the chemical has been sensed, and

the displayed representation of the physiological condition.

15. The method of claim 5, wherein the wand further comprises a chemical sensor, the method further comprising:

sensing via the wand a presence of a chemical indicative of explosives;

transmitting information indicative of whether the chemical is sensed; and

at the command site, displaying a representation of whether the chemical is sensed as indicated in the information.

16. The method of claim 15, further comprising:

at the command site, determining whether the vehicle has passed a vehicle inspection based on the displayed captured video and the displayed representation of whether the chemical has been sensed.

17. The method of claim 1, wherein the safe distance separating the command station and the inspection site is at least 1000 feet.

18. The method of claim 1, further comprising:

at the command site, observing the displayed captured video; and

at the command site, determining whether the vehicle has passed the vehicle inspection based on the observed video.

19. The method of claim 18, further comprising:

if it is determined that the vehicle passed the vehicle inspection, then transmitting instructions from the command site to the occupant, over the safe distance and through the wand, that direct the occupant to return to the vehicle and continue past the inspection site.

20. The method of claim 18, further comprising:

providing the personnel at the command site but not at the inspection site,

wherein the personnel perform said step of determining at the command site.

21. The method of claim 1, wherein said causing step includes:

positioning a selectively removable obstruction in a path of the vehicle.

22. The method of claim 1, wherein said step of instructing the occupant of the vehicle to exit the vehicle includes displaying instructions on a sign in view of the occupant while the occupant is in the vehicle.

23. The method of claim 1, further comprising transmitting bi-directional audio signals between the wand and the console in support of a two-way conversation between the occupant at the inspection site and the personnel at the command station, in order to facilitate the vehicle inspection.

24. A method of performing a search, comprising:

at a vehicle inspection site, providing a hand-held portable inspection wand including a video camera that captures video in a field-of-view extending from an end of the wand, a speaker, a microphone, a physiological sensor positioned so as to be in contact with a hand when grasping the wand, a chemical sensor and transceiver components coupled at least indirectly with the video camera, speaker, microphone, physiological sensor and chemical sensor;

at a command site separated a safe distance of at least 1000 feet from the vehicle inspection site, providing one or more enforcement personnel and equipment for displaying information and for transceiving information, including audio-visual information, sensed physiological condition and sensed chemical information, with the wand;

causing the vehicle to stop at the vehicle inspection site;

instructing an occupant of the vehicle to exit the stopped vehicle;

instructing the occupant to grasp the wand at the vehicle inspection site;

wirelessly transmitting instructions from the command site to the occupant at the vehicle inspection site, over the

safe distance and through the wand, that direct the occupant to inspect the vehicle using the wand, including capturing video of the vehicle using the wand;

capturing video of the vehicle using the wand responsive to the wirelessly transmitting step;

sensing via the wand a physiological condition of the occupant while the occupant grasps the wand;

sensing via the wand a chemical, if any, while the user inspects the vehicle;

transmitting the captured video from the wand to the command site;

transmitting from the wand to the command site information indicative of the sensed physiological condition;

transmitting from the wand to the command site information indicative of any sensed chemicals; and

at the command site, displaying the transmitted captured video, the information indicative of the sensed physiological condition, and the information indicative of the sensed chemical, if any;

at the command site, determining whether the vehicle and occupant have passed a check-point inspection based on whether any of the displayed captured video, the displayed sensed physiological condition, and the displayed sensed chemical, if any, indicate any of suspicious activity and a presence of a dangerous material.

25. A portable, hand-held inspection wand, comprising:

a substantially elongate housing having a front-end, the elongate housing being sized and shaped to be grasped by a hand of a user of the wand;

a video camera operable to capture video in a field of view (FOV) of the video camera extending away from the housing front-end;

a lamp positioned on the housing that illuminates the FOV;

a physiological sensor that senses a physiological condition of the user from the hand when in contact with the housing, and that produces a signal indicative of the physiological condition;

a microphone in the housing for receiving an audio signal from the user;

a speaker in the housing for announcing an audio signal to the user;

transceiver components, coupled to the video camera, the physiological sensor, the microphone and the speaker, that

wirelessly transmit the video captured by the video camera,

wirelessly transmit the physiological condition signal, and

wirelessly transmit the audio signal received by the microphone, and

wirelessly receive the audio to be announced by the speaker; and

a power source for powering the video camera, the lamp, the microphone, the speaker, the physiological sensor and the transceiver components.

26. The wand of claim **25**, further comprising:

a chemical sensor, coupled with the transceiver, for sensing chemicals and providing an indication of a sensed chemical, wherein the transceiver is configured to wirelessly transmit the indication of the sensed chemical.

27. A system for performing inspections, comprising:

(a) a portable hand-held wand, comprising:

a substantially elongate housing having a front-end, the housing being sized and shaped to be grasped by a hand of a user of the wand;

a video camera operable to capture video in a field of view (FOV) of the video camera extending away from the housing front-end;

a lamp positioned on the housing that illuminates the FOV;

a physiological sensor that senses a physiological condition of the user from the hand when in contact with the housing, and that produces a signal indicative of the physiological condition;

a microphone in the housing for receiving an audio signal from the user;

a speaker in the housing for announcing an audio signal to the user;

wireless transceiver components coupled to the video camera, the physiological sensor, the microphone and the speaker; and

(b) a console, comprising:

a microphone;

a speaker;

one or more displays; and

wireless transceiver components coupled to the console microphone, the console speaker and the console one or more displays, wherein

the video captured by the wand camera is wirelessly transmitted from the wand to the console, through the wand and console wireless transceiver components, and displayed on the console display,

audio sensed by the console microphone is wirelessly transmitted from the console to the wand, through the wand and console wireless transceiver components, and announced through the wand speaker,

audio sensed by the wand microphone is wirelessly transmitted from the wand to the console, through the wand and console wireless transceiver components, and announced through the console speaker, and

the signal indicative of the physiological condition is wirelessly transmitted from wand to the console, through the wand and console wireless transceiver components, and displayed on the one or more console displays.

28. The system of claim **27**, wherein the wand further comprises a chemical sensor for sensing one or more chemicals indicative of dangerous or illicit materials, and for producing a signal indicative of the sensed chemical, wherein the wand wireless transceiver components transmit the signal indicative of the sensed chemicals.

29. The system of claim **28**, wherein the console

wireless transceiver components receive the signal indicative of the sensed chemicals, and

the console one or more displays display the indication of sensed chemicals.

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